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ABSTRACT

This document highlights strategies for teaching science students with common learning disabilities. For each learning disability listed, there are sections on courtesy and several teaching methods with mitigative teaching strategies. Highlighted disabilities include Attention Deficit Disorder (ADD), Emotional Disabilities, Epilepsy, Hearing Impairments, Motor/Orthopedic Impairments, Learning Disabilities, and Vision Impairments. Among some recommended strategies discussed are teacher presentation, laboratory (active and passive), group interaction and discussion, research, testing, field experiences (active and passive), reading, and assistive devices, services, and materials. (JRH)

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Tips for Science Teachers Having Students with Disabilities

by Sheryl Burgstahler

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Tips for Science Teachers Having Students with Disabilities

Below is a listing of a series of common disabilities of science students. Under each of these disabilities are sections on courtesy and several teaching methods with mitigative teaching strategies. All of the strategies listed have been found to be effective with students having t disabilities listed. Because most disabilities are individual-unique, certain of the mitigative strategies given may not work. Also, this list is a work-in-progress and far from complete. We hope that you will be able to use the information as a reminder that these strategies are applications of common sense, but not of common knowledge.

E.C. Keller, Jr., West Virginia University

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STRATEGIES FOR TEACHING STUDENTS WITH ATTENTION DEFICIT DISORDER

Introduction

Attention deficit disorder (ADD) is a disorder characterized by serious and persistent difficulties in attention span, impulse control, and hyperactivity. ADD is a chronic disorder that can begin in infancy and extend through adulthood. It can have a negative effect on a child's life at home, school, and within the community. There are two types of attention deficit disorder: undifferentiated Attention Deficit Disorder (ADD), and Attention Deficit Hyperactivity Disorder (ADHD).

According to the criteria in the Diagnostic and Statistical Manual of Mental Disorders (3rd ed., rev.) (American Psychiatric Association, 1987), to be diagnosed as having ADHD a child must display, for six month or more, at least eight of the following characteristics prior to the age of 7: 1) fidgets, squirms, or is restless; 2) has difficulty remaining seated; 3) is easily distracted; 4) has difficulty waiting turn; 5) blurts out answers; 6) has difficulty following instructions; 7) has difficulty sustaining attention; 8) shifts from one uncompleted task to another; 9) has difficulty playing quietly; 10) talks excessively; 11) interrupts or intrudes on others; 12) does not seem to listen; 13) often loses things necessary for tasks; and 14) frequently engages in dangerous actions.

In Undifferentiated ADD, the primary and most significant characteristic is inattentiveness; but hyperactivity is not present. These children still manifest problems with organization and distractibility, even though they seem quite and passive. These children tend to be overlooked more easily in the classroom, and may be at a higher risk for academic failure than those with ADHD.

General Strategies

- Bring to the student's attention science role models with a similar disability. Point out that this individual got ahead by a combination of effort and by asking for help when needed.
- Seat students with ADD near the teacher's desk, but include them as part of the regular class seating.
- Place these students up front with their backs to the rest of the class to keep other students out of view.
- Surround students with ADD with good role models, preferable students whom they view as significant peers.
- Encourage peer tutoring and cooperative/collaborative learning.
- A class that has a low student-teacher ratio will be helpful to a student with ADD.
- Avoid distracting stimuli. Try not to place students with ADD near air conditioners, high traffic areas, heaters, doors, or windows.
- Avoid transitions, physical relocation, changes in schedule, and disruptions.
- Be creative! Produce a stimuli-reduced study area with a variety of science activities. Let all students have access to this area .
- Encourage parents to set up appropriate study space at home, with set times and routines established for study, parental review of completed homework, and periodic notebook and/or book bag organization.
- Educational, psychological, and/or neurological testing is recommended to determine learning style and cognitive ability and to rule out any learning disability (LD is common in about 30% of students with ADD).
- A private tutor and/or peer tutoring at school will be helpful to a student with ADD.

- Have pre-established consequence for misbehavior.
- Remain calm, state the infraction of the rule, and avoid debating or arguing with the student.
- **Providing supervision and discipline:**
  - Monitor proper behavior frequently and immediately direct student to the appropriate behavior.
  - Enforce classroom rules consistently.
  - Avoid ridicule and criticism. Remember, children with ADD have difficulty staying in control.
  - Avoid publicly reminding students on medication to "take their medicine."
- **Providing Encouragement:**
  - Reward more than you punish.
  - Immediately praise any and all good behavior and performance.
  - Change rewards if they are not effective in motivating behavioral change.
  - Find ways to encourage the child.
  - Teach the child to reward himself or herself. Encourage positive self-talk (e.g., "You did very well remaining in you seat today. How do you feel about that?"). This encourages the child to think positively about himself or herself.

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Teacher Presentation

- Maintain eye contact during verbal instructions.
- Make directions clear and concise. Be consistent with daily instructions.
- Simplify complex directions. Avoid multiple commands.
- Give out only one task at a time.
- Modify assignments as needed. Consult with special education personnel to determine specific strengths and weaknesses of each student.
- Gradually reduce the amount of assistance, but keep in mind that these children will need more help for a longer period of time than the average child.
- Require a daily assignment notebook as necessary and make sure each student correctly writes down all assignments. If a student is not capable of this, the teacher should help him or her.
- Initial the notebook daily to signify completion of homework assignments. (Parents should also sign.)
- Use the notebook for daily communication with parents.
- Develop an individualized education program.

Laboratory (active and passive)

- Make sure students comprehend the instructions before beginning their tasks
- Repeat instructions in a calm, positive manner, if needed.
- Help the students feel comfortable with seeking assistance (most children with ADD will not ask for help).
- Give out only one task at a time.
- Modify assignments as needed. Consult with special education personnel to determine specific strengths and weaknesses of each student.
- Keep in mind that children with ADD are easily frustrated. Stress, pressure, and fatigue can break down their self-control and lead to poor behavior.

Group Interaction and Discussion

- Help the students feel comfortable with seeking assistance (most children with ADD will not ask for help).

Field Experiences (active and passive)

- Monitor ADD students closely on field trips.

Research

- Help the students feel comfortable with seeking assistance (most children with ADD will not ask for help).
- Use appropriate lab and field strategies.

Testing

- Make sure you are testing knowledge and not attention span.
- Give extra time for certain tasks. Students with ADD may work slowly.
- Keep in mind that children with ADD are easily frustrated. Stress, pressure, and fatigue can break down their self-control and lead to poor behavior.

STRATEGIES FOR TEACHING STUDENTS WITH EMOTIONAL DISORDERS

Introduction

Emotional disorders can result from a variety of causes. However, the mitigative strategies for various symptomologies are similar. Hence, the strategies given below will work on most students with emotional disabilities.

General Courtesy

- Be positive and supportive.
- Develop a schedule for applying positive reinforcement in all educational environments.
- Encourage others to be friendly with students who have emotional disorders.
- Monitor the student's self-esteem. Assist in modification, as needed.
- Self-esteem and interpersonal skills are especially essential for all students with emotional disorders.

General Strategies

- Bring to the student's attention science role models with a similar disability. Point out that this individual got ahead by a combination of effort and by asking for help when needed.
- Ask previous teachers about techniques for interaction that have been effective with the student in the past.
- Find out whether the student is on medication, what the schedule is, and what the medication effects may be on his or her in class demeanor with and without medication. Then adjust your teaching strategies accordingly.
- Use time-out sessions to cool off disruptive behavior and as a break if the student needs one for a disability-related reason.
- In group activities, acknowledge the contributions of the student with an emotional disorder.
- Devise a contingency plan with the student in which inappropriate forms of response are replaced by appropriate ones.

Teacher Presentation

- After a week, or so, of observation try to anticipate classroom situations where the student's emotional state will be vulnerable for application of your mitigative strategies.
- By using examples, encourage students to learn science so they can apply it as adults.
- Check on the student's basic capacity to communicate and adjust your communications accordingly.

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Laboratory (active and passive)

- Be sensitive when making team pairings so that the student with an emotional disorder is supported.
- Use appropriate general strategies.

Group Interaction and Discussion

- Acknowledge the contributions of the student with an emotional disorder.
- Call for responses and participation commensurate with the student's socialization skills.
- As the student's comfort level rises and when a safe topic is available, encourage the student to be a group spokesperson.
- With the student, devise a contingency plan in which inappropriate forms of response are replaced by appropriate ones.
- Gradually increase the challenges in the student's participation in exercises while providing increased positive reinforcement.
- Help the student to feel as though he or she has something worthwhile to contribute to the activities.
- Provide opportunities in which leadership can emerge.

Field Experiences (active and passive)

- In group activities acknowledge the contributions and assistance of the student with an emotional disorder.
- Help the student to feel as though he or she has something worthwhile to contribute to the activities.
- Use a buddy system.
- Gradually increase the challenges in the student's participation in exercises while providing increased positive reinforcement.
- Use appropriate general strategies.

Research

- Use appropriate lab and field strategies.

Testing

- Be sensitive to the student's reactions to aspects of assessment.
- For each student, accumulate in his or her portfolio several examples of work (quizzes, assignments, projects) that demonstrate knowledge of the subject matter or unit of study.
- Make special arrangements for the student with an emotional disorder according to what their special needs are and that they do not compromise the integrity of the testing situation.
- Stay on top of student progress, don't wait until it's too late to discover that there is a problem.

STRATEGIES FOR TEACHING STUDENTS WITH EPILEPSY

Introduction

Epilepsy is not a disease, but a malfunction of the electrical pathways in the neurons (nerve cells) of the brain. Epileptic seizures are a result of these neuro-electrical irregularities in the brain neurons. Anti-convulsant medication can either completely or partially control seizures in approximately 80 percent of the epileptic individuals. A major problem with epileptic students whose seizures are not completely controlled by medication is the non-predictability of the occurrence of seizures.

General Strategies

- Bring to the student's attention science role models with a similar disability. Point out that this individual got ahead by a combination of effort and by asking for help when needed.
- During a student's epileptic seizure, the first rule is for you to remain calm.
- There is nothing you can do to stop the seizure once it has begun.
- Do not try to restrain the individual.
- If it is a convulsive seizure, lower the person to the ground or floor in a cleared area, if possible, and clear the area of furniture or materials in order to avoid injury.
- Try not to interfere with movements in any way.
- Loosen ties and shirt collars, and place something soft under his/her head.
- When the person regains consciousness, reassure him/her and ask what additional assistance is needed.
- If a seizure lasts longer than 10 minutes, or if multiple seizures occur without the person regaining consciousness, treat it as a medical emergency and call 911.
- For a non-convulsive seizure, no medical action is typically needed. Stay with the individual and gently guide them away from obvious hazards. Speak calmly and be reassuringly to him/her.
- Stay with the person until they are completely aware of the environment around them.

STRATEGIES FOR TEACHING STUDENTS WITH HEARING IMPAIRMENTS.

Introduction

Over time, the average hearing impaired student, as compared to students with normal hearing , shows an ever increasing gap in vocabulary growth, complex sentence comprehension and construction, and in concept formation. Hearing impaired students often learn to "feign" comprehension with the end result being that the student does have optimal learning opportunities. Therefore, facilitative strategies for hearing impaired students are primarily concerned with various aspects of communication. Other problems arise because deafness is an invisible disability. It is easy for teachers to "forget about it" and treat the student as not having a disability. It has also been shown that hearing impaired students with good English skills also have good science concept formation. (After "Mainstream Teaching of Science: A Source Book", Keller et al.)

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General Courtesy

(Note: all of these strategies will work on some of the students--some strategies will not. The degree of impairment and the background training of the student will affect the usefulness of the various strategies).

- When communicating, always face the student with a hearing impairment.
- If not facing a student with a hearing impairment, gently touch a student on the shoulder or on the arm to indicate that you want to talk to him/her.
- Facial expressions, gestures, and other body language will help convey your message.
- Avoid seating the student in heavy traffic areas.
- Do not touch or pet a hearing dog. These animals are working animals and it may be hazardous for the hearing impaired student if the dog is distracted.
- Avoid vibrations and excessive noise.
- Make chalkboard notes legible.
- Do not talk while writing on chalkboard.
- Do not be alarmed if the student does not understand and you cannot understand him/her. Generally, you will become accustomed to each other in time.
- Eliminate background noises. Sounds taken for granted and normally ignored by hearing individuals, are amplified by a hearing aid and interfere with the communication of the person who is hard of hearing.
- Establish, with the student, a procedure in case of an emergency. For example, agree that for a fire drill (or fire) the teacher will write on board "Fire drill FIRE--go out backdoor." (Also, if you have a signing student, learn the signs for emergency, fire, go, etc.)
- Get the attention of a person with a hearing impairment before speaking.
- If necessary, use written notes to communicate.
- Supplement audible alarm systems with simple visual alarms such as flashing lights.
- When teaching a student with a hearing impairment, ask where he/she would like to sit, in order to communicate in an optimal manner.

General Strategies

- Bring to the student's attention science role models with a similar disability. Point out that this individual got ahead by a combination of effort and by asking for help when needed.
- Speak expressively to the student, also, rely on facial expressions, gestures, and body movements to assist in communication.
- Obtain feedback from your hearing impaired students at every opportunity as an indicator of the student's level of understanding.
- **If the student lip-reads:**
  - Have students sit closer to the lecturer.
  - Look directly at the student.
  - Speak slowly, naturally and clearly.
  - Slowing down slightly may help.
  - Do not exaggerate your lip movements or shout.
  - If you have a mustache, keep it well trimmed.
- **If the student uses an interpreter:**
  - Speak directly to the student rather than to the interpreter.
  - Signing may be distracting at first, but you and the other students will soon become accustomed to the interpreter's presence.
  - Give the student and the interpreter outlines of the lecture or written material, in advance, so that they can become familiar with new technical vocabulary.
  - Interpreters should not give their opinion of a student's progress as this can violate the student's rights.
  - Provide scripts of video and laser media when possible for both the interpreter and the student with a hearing disability (with or without captioning).
  - The interpreter is not to answer lesson related questions from the student with a hearing impairment. The student should direct all lesson related questions to the instructor.
  - The interpreter should stand closer to the section of the chalkboard that is being used by the instructor, thereby allowing the student to simultaneously see both the signs and the writing on the board.

Teacher Presentation

- Avoid standing in front of windows or light sources that may silhouette the instructor and hinder visual cues.
- Begin explanations with concrete examples, working from the concrete to the abstract.
- Present only one source of visual information at a time (reduce visual pollution). Leave on the chalkboard only what you are discussing.
- Engage the attention of the student with a hearing impairment before communicating with the class.
- If possible, face the light source and keep your hands away from your face when speaking.
- Use an ***FM audio trainer*** for hard-of-hearing students.
- If a lip reader, refer to General Strategies.
- **Use captioned films/videos/laser disks.**
- If the student with a hearing impairment does not understand, try repeating. If the student still does not understand, rephrase a thought or use a different word order.
- Maximize the use of visual media.
- ***Carbonless note taking paper*** can be used. The paid or volunteer note taker needs to take legible notes and then give the student with a hearing impairment the original (or a copy).
- It is crucial that students with hearing impairments have good note takers. It is impossible to simultaneously lip-read and take notes, or to watch/read an interpreter and take notes.
- Obtain feedback from your student at every opportunity as an indicator of the student's level of understanding.
- For reinforcement repeat new vocabulary in different contexts.
- Sequence topics so that new material is related to that previously learned.

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- The use of visual aids is most helpful since vision is the student's primary means of receiving information.
- Use written announcements (assignments, due dates, exam dates, changes in the class schedule, special event dates, etc.).
- If ambiguities or difficulties arise in the home concerning assignments or lessons, have the parents make a note of these difficulties. Follow-up in written detail.
- Provide an outline of the lesson/activity to give to the student in advance, also give your expectations.
- Write all homework assignments, class instructions, and procedural changes on the chalkboard.
- Use captioned films, videos, and laser disks.
- Use interpreter where needed (see general strategies).
- Avoid seating the student in heavy traffic areas.

Laboratory (active and passive)

- Refer to the section on interpreters and lip reading above in General Strategies.
- Avoid seating the student in heavy traffic areas.
- As you demonstrate a procedure or technique, deliberately alternate between speaking and manipulating the materials. This allows the student who is hearing impaired to look at one thing at a time.
- If the student does not understand, try repeating; if the student still does not understand, rephrase a thought or use a different word order.
- Keep visual pollution on chalkboard to a minimum. Leave on the chalkboard only what you are discussing.
- Write new vocabulary words on the chalk board before a lesson or laboratory.
- Make chalkboard notes legible.
- Do not talk while writing on chalkboard.
- Maximize the use of visual media and demonstrations.
- Repeat new vocabulary in different contexts for reinforcement.
- Assign students with hearing impairments to a laboratory station that allows an unobstructed view of the chalkboard and the instructor and/or interpreter.
- Begin explanations with concrete examples, working from the concrete to the abstract.
- Insure that the student with a hearing impairment receives information about any changes in experimental procedure by writing on the board or paper.
- Label equipment and materials to aid in the learning of new vocabulary items.
- Provide concise, step-by-step directions prior to the laboratory activity and preview it with the student, if possible.
- Provide indicator lights for the on/off status of equipment.
- When a partner is needed, the teacher should assist in finding an understanding lab partner for a student with a hearing impairment.
- Use ***captioned film/video/laser disk*** material.
- Obtain feedback from your hearing impaired students at every opportunity as an indicator of the student's level of understanding.
- Use ***signaling devices*** to alert the student to a particular sound in the lab.
- Use an ***overhead projector*** to show step-by-step instructions, this allows the teacher to better communicate with the student.
- Mask all the instructions except the one that you want followed next.
- Write new vocabulary words on the chalk board before a lesson or laboratory.
- Provide an outline of the lesson/activity/handout to the student in advance, and give your expectations.
- Write all homework assignments, class instructions, and laboratory procedural changes on the chalkboard.
- Present only one source of visual information at a time.
- Use written announcements (assignments, due dates, exam dates, changes in the class schedule, special event dates, etc.).
- Provide an outline of the activity and give to the student ,in advance, also give your expectations.
- If non-captioned videos or movies are shown, a dim light is needed so that the student who uses an interpreter can see the interpreter's signing.

Reading

- Provide or adapt reading materials at appropriate reading levels and provide resource material at these same reading levels.
- Use high visuality (many figures, pictures, and diagrams) in reading assignments.
- **When writing materials for hearing impaired students:***
  - Break up long sentences.
  - Reduce difficult vocabulary load.
  - Reduce concept density.
  - When using a pronoun be sure that the antecedent is very clear.
  - Don't omit words such as: *that*, where they will clarify a sentence connection.
  - Stay with simple coordinating conjunctions (e.g., but, *so, for, and*) and avoid less common transitional words (e.g., however, *as a consequence, nevertheless, although*).
  - Keep cause-and-effect expressions very simple in form.
  - Keep conditional expressions which influence the meaning of a statement (such as; *if, when, assuming that,, suppose, provided that*, etc.) to a minimum.
  - If there is no other way to avoid using a difficult word, include a brief explanation in parentheses, however keep parenthetical explanations to a minimum.
  - **If an important basic or technical word is to be taught:**
    - Make meaning and application absolutely clear.
    - Use context as a memory aid.
    - Repeat the word numerous times in a variety of contexts.
  - **Certain language forms are generally to be AVOIDED:**
    - Passive voice verbs.
    - Negative forms of verbs and other expressions of negation.

* The latter part of this reading section is adapted from Mainstreaming by Bishop.

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- Too many modifying forms, such as prepositional phrases, relative clauses. (if a relative clause must be used , the relative pronoun [who, which, that, where, etc.] should be next to the word to which it refers).
- Stylistic embellishments, such as rhetorical inversions.
- Colloquial and idiomatic expressions.
- Cut wordiness while retaining simple English.
- Avoid the use of idioms.

Group Interaction and Discussion

- Be sure that the students know which topic is being discussed.
- Expect and encourage the student to participate in class by answering questions, giving reports, and volunteering for other verbal activities, if possible.
- Clearly identify who is speaking or asking a question (pointing is OK).
- In group or team settings, develop procedures so the student who is hearing impaired can express his/her communication needs to others.
- In group situations or discussions which include a student who is speech reading (lip reading) it is very helpful to have students sit in a horseshoe or circle for better inclusion of students with hearing impairments.
- Repetitions or summaries of the most relevant classroom questions, responses, and discussions are helpful to the student with a hearing impairment.
- If not in a circle, seat the student with his/her "better" ear towards the class.
- Show special awareness. Call the person who has a hearing impairment by name to initiate communication, (or a nod or a hand gesture is acceptable).
- You may need to get the student's attention by tapping him/her gently on the shoulder, arm, or waving your hand or using a similar visual signal.

Field Experiences (active and passive)

- Adapt as many activities as possible to a visual mode.
- Allow for direct access to and manipulation of materials, whenever possible.
- Use flash cards for clarity in field exercises.

Research

- Use appropriate lab and field strategies.

Testing

- After tests or quizzes, give answers by using the overhead projector or give answers in writing.
- Avoid overly complicated language in exam questions and clearly separate items when spacing them on the exam sheet. (See last part of Reading section above on writing for students with hearing impairments.)
- Avoid the use of abbreviations or idioms, except for standard ones.
- Due to difficulty with vocabulary, students may require extra time .
- Interpreters may be asked to interpret a test. Because of the complex language involved, an interpreter can often rephrase a question so that a student is able to better understand the intent of the question.
- Interpreters should not be used as proctors for tests.
- Supplement oral or signed explanations with written material.
- Use short sentences because they are easier and quicker to comprehend than longer sentences.
- Keep reading materials of the test at appropriate reading levels.

Assistive Devices, Services, and Materials

- ***Captioned video , films, or laser disk*** materials- Captioning is a visual interpretation of the audio portion of the tape or program being shown. It is either closed (needs switch on TV to activate) or open (on all the time).
- ***FM Audio Trainer*** -from L&S. An FM broadcasting system for hard of hearing persons. The instructor has a broadcast unit (on belt) and a microphone and the student has a receiver and ear phones (can broadcast to more than one student).
- ***Carbonless note taking paper***--**(also called NCR paper).** Imprint is from writing on the cover sheet -- copy is from chemical transfer via pressure change (available at most printing shops).
- ***Pocket Talker***--a personal amplification system where a microphone is placed near the sound to be heard.
- ***Signaling Devices***-- alerts the student that a particular sound is occurring (e.g., a timer going off) by using a visual or vibrating signal.
- ***Hearing Ear Dogs***- mobile "ears" for a person with a hearing impairment.

STRATEGIES FOR TEACHING STUDENTS HAVING MOTOR/ORTHOPEDIC IMPAIRMENTS

Introduction

Motor impaired/orthopedic disabilities includes a heterogeneous grouping of conditions with a wide range of causes. Examples are:
• **Nervous system disorders** • **Traumatic spinal cord injury** •**Stroke** • **Muscular Dystrophy** • Cerebral Palsy • Epilepsy
• **Muscular-skeletal disorders** •**Rheumatoid arthritis** • **Cardio-vascular disease** • **Coronary heart disease** • **Respiratory**
• Emphysema • Asthma • **Endocrine-metabolic** • Diabetes • **Amputation of all types.**

One of the first considerations in the effective science education of individuals with motor/orthopedic impairments is a brief understanding of his/her impairment and the degree of educational limitation it causes. With such information, a set of mitigative strategies can be derived that are specific and fully appropriate to that particular student, however, (some of the strategies may not work for every student). (After "Mainstream Teaching of Science: A Source Book", Keller et al.)

General Courtesy

- Accept the fact that a disability exists. Not acknowledging this fact is not acknowledging the person.
- Ask the student to tell you when he/she anticipates a need for assistance.
- Don't lean on a student's wheelchair. The chair is a part of the body space of the student who uses it.
- Don't patronize students who use wheelchairs by patting them on the head. This is a sign of affection that should be reserved only for small children, and most of them do not like it.
- Encourage students who use crutches or canes to keep them within easy reach and make such a space available.
- Only push a wheelchair when asked.
- Have custodians use non-skid floor polish for students who use crutches and wheelchairs.
- If spills occur, keep floors clear of liquids.
- If writing is difficult, use a tape recorder.
- Speak directly to the student with a disability as you would other students.
- Students should be encouraged to talk with their instructors during the first week of classes to discuss their functional difficulties and needs and to talk about ways to compensate.
- Using a wheelchair when the person can walk with the aid of cane(s), brace(s), crutche(es), or a walker does not mean a student is "feining" the degree of disability. It may be a means to conserve energy or move about more quickly.
- When it appears that a student needs help, ask if you can help. Accept a "no thank you" graciously.
- When talking to a student who uses a wheelchair for more than a few minutes, or so, sit down or kneel to place yourself at that person's eye level.
- Words like "walking" or "running" are appropriate. Sensitivity to these words is not necessary. Students who use wheelchairs use the same words.

General Strategies

- Bring to the student's attention science role models with a similar disability. Point out that this individual got ahead by a combination of effort and by asking for help when needed.

Teacher Presentation

- If breaks between classes are short (10 minutes or less), the student who has a mobility impairment may frequently be a few minutes late. Students and instructors may want to plan for these occasions, so students don't miss important material.
- Observe potential obstacles so you can be aware of what is accessible and what is not accessible to students in wheelchairs.
- Students may need to tape lectures (difficulty with writing or unable to write).
- Table-type desks, which have enough clearance for wheelchairs can be moved into classrooms.

Laboratory (active and passive)

- Adaptations such as: ***latching devices***, ***keylocks***, ***headmaster,*** and ***light talkers*** that simplify access to computers can greatly help the motor/ orthopedic science student.
- Allow more time for the student to complete the activities.
- Alter the height of tables to "fit" the students (e.g., a small ramp with platform for high desks).
- Anticipate areas of difficulty in access and involve the student with disability in doing the same. Together, work out alternate procedures while trying not to disengage the student from the activity.
- Assign a lab partner who can help to reach or manipulate objects as needed.
- Be aware of and prevent possible overheating of students who have poor heat regulation.
- Have students in wheelchairs participate in activities as fully as possible.
- Built-in lab tables (or samll ramp/platforms) may need to be modified to accommodate wheelchairs.
- For students who cannot use the computer because of physical limitations in their hands or arms, explore avenues for obtaining ***adaptive access software***, ***altered keyboards*** (including ***Unicorn keyboards***), ***special switches (latching devices, keylocks), and Power Pads***, ***eye-controlled input systems***, ***touch-screens*** in conjunction with a ***light talker***, ***trackballs, footmice*** , and other special equipment.
- If appropriate, provide assistance, but also provide positive reinforcement when the student shows the ability to do something unaided.
- If breaks between classes are short (10 minutes or less), the student who has a mobility impairment may frequently be a few minutes late. Students and instructors may want to plan for these occasions, so students don't miss aspects of the activity.
- In lab, place water, gas, and electric facilities in accessible locations.
- Increase size of wheels, dials, handles, and buttons on lab equipment.
- Lower supplies and equipment for easier access, or simply give them to the student as needed.
- Perhaps a change in aisles (by relocating desks and/or chairs) is needed for wheelchair access.
- Provide an accessible means for the recording of data, charts, or graphs
- Select non-manual types of laboratory teaching techniques (e.g., electronic probes vs. pipette bulbs).
- Table-type desks, which are high enough for wheelchairs can be moved into labs.
- Use a peer-buddy system.
- Use electric hot plates instead of Bunsen burners as heat sources.
- Use laboratory sinks that are accessible from 3 sides.
- Use low-force electric microswitches for lights and equipment.
- Use modified lids on the tops of containers (wider and bigger).
- Use a portable eye wash.
- When information gathering involves a physical action that the student cannot perform, try using a different type of experience that will yield the same information.

Field Experiences (active and passive)

- Anticipate areas of difficulty and involve the student with a disability in doing the same. Together, work out alternate procedures while trying not to disengage the student from the activity.

- Be sure students in wheelchairs can fully participate in activities.
- If a class involves field work or field trips, the students using a wheelchair will probably need other travel arrangements because they often need to rely on attendants, ramp adapted vans for transportation, or power lift vans for transportation to and from field activities.
- For students who cannot use the computer because of physical limitations of their hands or arms, explore avenues for obtaining ***adaptive access software***, ***altered keyboards*** (including ***Unicorn keyboards***), ***special switches*** (***latching devices, keylocks***), ***Power Pads***, ***touch-screens*** in conjunction with a ***light talker***, ***trackballs*** and ***footmice***, and/or other special equipment.
- In the field, provide assistance, but also provide positive reinforcement when the student shows the ability to do something unaided.
- Increase size of wheels, dials, handles, and buttons on field equipment.
- Use a peer-buddy system.
- Use modified lids on the tops of containers (wide and bigger).
- When information gathering involves a physical action that the impaired student cannot perform, try a different experience yielding the same information.
- Make special advance arrangements with curators during passive visiting field trips.
- Make sure that field activity sites are accessible. Check the following:
  - Are there nearby parking spaces reserved for persons with disabilities?
  - Is there a ramp or a step-free entrance?
  - Are there accessible rest rooms?
  - If the site is not on the ground floor, does the building have an elevator?
  - Are water fountains and telephones low enough for a student in a wheelchair?
  - Discuss any needs, problems, or alternatives with the student.

Research

- For students who cannot use the computer because of physical limitations in their hands or arms, explore avenues for obtaining ***adaptive access software***, ***altered keyboards*** (including ***Unicorn keyboards***), ***special switches*** (***latching devices, keylocks, and Power Pads***), ***touch-screens*** in conjunction with a ***light talker***, ***trackballs*** and ***footmice***, and other special equipment.
- Depending on the site of the research check the previous two sections.
- Use appropriate lab and field strategies.

Testing

- Allow more time for the student to complete the activities.
- Give completely oral tests or completely written tests, whichever is more appropriate.
- Students could tape record answers to tests or type answers, if needed.
- Writers should be provided for test-taking if the student is unable to write.
- Students may write slowly and need extended time for tests.
- Develop a portfolio of the student's work, both singly and as part of a cooperative group. Orally quiz him/her to establish the extent to which the student contributed to the group-based accomplishments.

Assistive Devices, Services, and Materials

- ***Latching Devices*** - made for a one-handed/arm person which lets the user press keys in sequence instead of in combination.
- ***Touch Screen*** - allows the user to enter words, draw graphics, compute, and do other work by touching the screen.
- ***Headmaster*** - a keyboard modification that uses a headpointer to translate a change in the user's head position into changes in the position of the cursor on screen.
- ***Power Pad*** - a touch sensitive board which turns the computer into a drawing, communication, and educational tool.
- ***Light Talker*** - uses a light beam head pointer as an input device on a computer.
- ***Trackball*** - an upside down mouse with a ball protruding from the center of a box, allowing a person with limited hand/arm motion to move the cursor.
- ***Footmouse*** - similar to a trackball, but operated by foot movement.
- ***Keylocks*** - keyboard modifications designed to enable the user to press more than one key at a time.
- ***Eye controlled input system*** - an interface which tracks eye movements of the user as he/she looks at an on-screen keyboard.

STRATEGIES FOR TEACHING STUDENTS WITH LEARNING DISABILITIES

Introduction

Most people know, or are taught, at an early age, how to process information and develop an organized plan or strategy when confronted with a problem, whether that problem is social, academic, or job related. Others find this cognitive process quite difficult. Learning disabilities have only recently been recognized as disabilities, however, these students can be taught effective learning strategies that will help them approach tasks more effectively. (From: "Learning Strategies for Problem Learners", by Thomas Lombardi).

General Courtesy

- Don't assume that the person is not listening just because you are getting no verbal or visual feedback.
- Don't assume that you have to explain everything to students with learning disabilities. They do not necessarily have a problem with general comprehension.
- Consult with the special education specialist to obtain help in understanding the specific nature of the learning disability for each student.
- Never assess a student's capabilities based solely on their I.Q. scores.

General Strategies

- A student may have documented intelligence with test scores in the average to superior range with adequate sensory and motor systems and still have a learning disability. Learning disabilities often go undiagnosed, hence teacher observation can be a major source of identification
- Bring to the student's attention science role models with a similar disability. Point out that this individual got ahead by a combination of effort and by asking for help when needed.

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Teacher Presentation

- Always ask questions in a clarifying manner, then have the students with learning disabilities describe his or her understanding of the questions.
- Use an ***overhead projector*** with an outline of the lesson or unit of the day.
- Provide clear photocopies of your notes and overhead transparencies.
- Provide students with chapter outlines or study guides that cue them to key points in their readings.
- Provide a detailed course syllabus before class begins at the beginning of the semester or quarter.
- Ask questions in a way that helps the student gain confidence.
- Keep oral instructions logical and concise. Reinforce them with a brief cue words.
- Repeat or re-word complicated directions.
- Frequently verbalize what is being written on the chalkboard.
- Eliminate classroom distractions such as, excessive noise, flickering lights, etc.
- Outline class presentations on the chalkboard or on an overhead transparency.
- Outline material to be covered during each class period unit. (At the end of class, summarize the important segments of each presentation.)
- Establish the clarity of understanding that the student has about the assignment.
- Give assignments both in written and oral form.
- Have more complex lessons recorded and available to the students with learning disabilities.
- Have practice exercises available for lessons, in case the student has problems.
- Have students with learning disabilities underline key words or directions on activity sheets (then review with them) .
- Make a complex homework assignment due in two or three days rather than on the next day.
- Pace instruction carefully to ensure clarity.
- Present new and or technical vocabulary on the chalkboard.
- Provide and teach memory associations (mnemonic strategies).
- Support one modality of presentation by following it with instruction and then use another modality.
- Talk distinctly and at a rate that the student with a learning disability can be follow.
- Technical content should be presented in small incremental steps.
- Use plenty of examples, oral or otherwise, in order to make topics more applied.
- Use straight forward instructions with step-by-step unambiguous terms. (Preferably, presented one at a time).
- Write legibly, use large type; do not clutter the blackboard with non-current / non-relevant information.
- Use props to make narrative situations more vivid and clear.
- Use a ***tape recorder***
- Assist the student, if necessary, in borrowing classmates' notes.
- Consider cross-age or peer tutoring if the student appears unable to keep up with the class pace or with complex subject matter. The more capable reader can help in summarizing the essential points of the reading or in establishing the main idea of the reading.

Laboratory (active and passive)

- Clearly label equipment, tools, and materials. Color code them for enhanced visual recognition.
- Provide clear photocopies of your notes and overhead transparencies.
- Make available for students with learning disabilities cue cards or labels designating the steps of a procedure to expedite the mastering
- Use an ***overhead projector*** with an outline of the lesson or unit of the day.
- Allow extended time for responses and the preparation and delivery of reports.
- In dealing with abstract concepts, use visual tools such as charts and graphs. Also, paraphrase and present them in specific terms, and sequence.
  illustrate them with concrete examples, personal experiences, or hands-on exercises.
- To minimize student anxiety, provide an individual orientation to the laboratory and equipment and give extra practice with tasks and equipment.
- Find areas of strength in the student's lab experiences and emphasize those as much as possible.
- Allow the students with learning disabilities the use of computers and spell checking programs on assignments.

Reading

- Announce readings as well as assignments well in advance.
- Find materials paralleling the textbook, but written at a lower reading level. (Also, include activities that make the reading more relevant.)
- Introduce simulations to make abstract content more concrete.
- Make lists of required readings available early and arrange to obtain texts on tape from Recording for the Blind or a Reading/Taping Service.
- Offer to read written material aloud, when necessary.
- Read aloud material that is written on the chalkboard on the overhead transparencies.
- Review relevant material, preview the material to be presented, present the new material then summarize the material just presented.
- Suggest that the students use both visual and auditory senses when reading the text.
- Rely less on textbooks. Reading for students with learning disabilities may be slow and deliberate, and comprehension may be impaired fo the student , particularly when dealing with large quantities of material. Comprehension and speed usually dramatically increase with the addition of auditory input.
- Spend more time on building background for the reading selections and creating a mental scheme for the organization of the text.
- Encourage students to practice using technical words in exchanges among peers.
- Choose books with a reduced number of difficult words, direct non convoluted syntax, and passages that deliver clear meaning. Also select readings that are organized by subheads because this aids in the flow of ideas.
- When writing materials for reading by students with learning disabilities, some of the strategies referred to in the reading section of the hearing impaired presentation will be appropriate.
- Use a ***tape recorder.***

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Group Interaction and Discussion

- Always ask questions in a clarifying manner, then have the students with learning disabilities describe his or her understanding of the questions.
- Assist the student, if necessary, in borrowing classmates' notes.
- Encourage questions during or after class to ensure that materials are understood by students with learning disabilities.
- Give individual conferences to guide students with learning disabilities. (Monitor progress and understanding of the assignment and of the course content).
- Give plenty of reinforcement when it is evident that the student with a learning disability is trying things that are made difficult by the disability.
- Have frequent question-and-answer sessions for students with learning disabilities.

Field Experiences (active and passive)

- Allow the students with learning disabilities the use of computers and spell checking programs on assignments.

Research

- Use appropriate lab and field strategies.

Testing

- Avoid overly complicated language in exam questions and clearly separate items when spacing them on the exam sheet. (Refer to writing for students with hearing impairments in the reading section.)
- Consider other forms of testing (oral, hands-on demonstration, open-book etc.). Some students with learning disabilities find that large pri helps their processing ability.
- Consider the use of illustrations by the students with learning disabilities as an acceptable form of response to questions in lieu of written responses.
- Eliminate distractions while taking exams.
- For students with perceptual problems, for whom transferring answers is especially difficult, avoid answer sheets, especially computer forms Allow them to write answers (check or circle) on the test (or even dictate their responses.)
- Gradually increase expectations as the students with learning disabilities gains confidence.
- Grant time extensions on exams and written assignments when there are significant demands on reading and writing skills.
- If distractions are excessive, permit the students with learning disabilities to take examinations in a separate quiet room with a proctor.
- Provide study questions for exams that demonstrate the format along with the content of the exam.
- Review with the student how to proofread assignments and tests.
- Do not test material just presented or outcomes just produced, since for the students with learning disabilities, additional time is generally required to assimilate new knowledge.
- Permit the students with learning disabilities the use of a dictionary and/or thesaurus and a calculator during tests.

Assistive Devices, Services, and Materials

- ***Overhead projector*** sometimes refers to either transparent or opaque.
- ***Tape Recorder*** - standard or 4- track variable speed.

STRATEGIES FOR TEACHING STUDENTS WITH VISION IMPAIRMENTS

Introduction

The definition of legal blindness covers a broad spectrum of visual disabilities. Hence, there is no "typical" vision impaired student. The extent of visual disability depends upon the physical impairment of the student's eyes, the age of the student at onset of vision impairment, and the way in which that impairment occurred. The major challenge facing visually impaired students in the educational environment is the overwhelming mass of visual material to which they are continually exposed in textbooks, class outlines, class schedules, writing on chalkboards, etc. In addition, the increasing use of films, videotapes, computers, and television adds to the volume of visual material to which they have little or no access. Overcoming students' visual limitations requires unique and individual strategies based on a student's particular visual impairment and skill at communication (e.g., Braille, speed listening, etc.). (After: "Mainstream, Teaching of Science: A Source Book", Keller et al.)

General Courtesy

- Speak to the class upon entering and leaving the room or site.
- Call the student by name if you want his/her attention.
- Use descriptive words such as straight, forward, left, etc. in relation to the student's body orientation. Be specific in directions and avoid the use of vague terms with unusable information, such as "over there", "here", "this", etc.
- Describe, in detail, pertinent visual occurrences in the activities.
- Describe and tactually familiarize the student to the classroom, laboratory, equipment, supplies, materials, field sites, etc.
- Give verbal notice of room changes, special meetings, or assignments.
- Offer to read written information for a person with a visual impairment, when appropriate.
- Don't assume that the student who is visually impaired will recognize you by your voice even though you have met before. Identify yourself by name.
- If you are asked to guide a student with a visual impairment, identify yourself, offer your services and, if accepted, offer your arm to the student's hand. Tell them if they have to step up or step down, let them know if the door is to the left or right, and warn them of possible hazards.

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- Let the student know if you move or need to end a conversation.
- Routinely check the instructional environment to be sure it is adequate and ready for use by a visually impaired student.
- When communicating with a student who has a vision disability, always identify yourself and others who are present.
- Do not pet or touch a guide dog. Guide dogs are working animals. It can be hazardous for the visually impaired person if the dog is distract
- Be understanding of the slight noise made by a portable Brailler.
- Use an auditory or tactile signal where a visual signal exists.
- Don't speak loudly to people with visual impairments.

Color Blindness

- Students with color blindness can become adept at hiding their deficiencies. (They learn to watch their classmates and copy their behaviors and responses.) They need to have closely monitored activities to assure appropriate observations.
- Students with color blindness will exhibit a broad range of unusual responses to school activities, from loss of interest to complete withdrawal from participation. These and negative social interactions should be attended to as soon as they are noticed.
- Upon suspicion of a color deficiency, administering the Ishihara or American Optical Tests for early diagnosis is recommended.
- Color deficiency teaching strategies are quite dependent on the type of colorblindness and consultation with the student will result in appropriate mitigative strategies of color adjustment or black and white alternatives.

General Strategies

- The various strategies will work for many students--some will not. The degree of impairment and the student's background and training (like Braille) will affect the usefulness of the various strategies. The student with a vision impairment will most likely need assistance in accessing instructional materials, taking notes, and/or taking tests. Translation of pictorial, graphic, or displays (but untouchable) into a meaningful and comprehensible form; the student's identification analyses; and differentiation of items where touch will not discriminate; and in orientation and mobility in unfamiliar situations. (There are many instruments which provide adaptive alternatives----like a ***talking calculator*** or computer systems with a ***synthesizer***).
- Bring to the student's attention science role models with a similar disability. Point out that this individual got ahead by a combination of effort and by asking for help when needed.

Teacher Presentation

- By spelling out new or technical vocabulary, you will be greatly helping the visually impaired student, as well as other students.
- Use tactile models to show students with visual impairments what you visually show non-impaired students.
- Use an enlarged activity script or tape to go along with tactile models or other educational items.
- Use an ***overhead projector*** to show step-by-step instructions. Mask all the instructions except the one(s) that you want followed next.
- Use an ***opaque projector*** whenever possible to enlarge visuals.
- All colored objects related to a lesson or experiment should be Braille labeled or otherwise coded.
- Describe in detail, visual occurrences and directions including all aspects that involve sight.
- Use a sighted narrator or ***descriptive video*** to describe videos or laser disks.
- Describe, in detail, all visual occurrences or chalkboard writing.
- Do oral translations of visual media used in class.
- Where needed, have lesson materials Brailled or labeled ahead of time.
- Have ***3-D models*** or ***thermoforms*** available to supplement graphics in a tactile format when needed.
- Use actual objects for three dimensional representations whenever possible.
- Modify instructions for auditory/tactile presentation.
- Use ***raised line drawings*** for temporary tactile presentations.
- Use the overhead, chalkboard, graphs, or slides as you would normally, but provide more oral descriptions, supplement with thermoforms where appropriate.
- When a student with color deficiency is in class, design lessons that use bright, non-pastel colors that are extreme opposites.
- Allow student to use a ***tape recorder***.
- Make all handouts and assignments available in an appropriate form: e.g., regular print, large print, Braille, or cassette.

Laboratory (active and passive)

- Use an enlarged activity script or tape to go along with tactile models and experimental or other activities.
- Make all handouts and assignments available in an appropriate form: e.g., regular print, large print, Braille, or tape.
- Describe and tactually/spatially familiarize the student to the laboratory.
- Assistance from a special education consultant may be needed for converting materials from a visual to a tactile format.
- Describe and tactually/spatially familiarize the student with the lab and all equipment to be used.
- Have the student do a trial run on the equipment before the activity.
- Allow more time for activities.
- Keep materials, supplies, and equipment in the same place whether it is on a laboratory table or on a shelf.
- Use a ***microprojector*** to help the visually impaired student examine images from the microscope.
- Place the student and/or ***tape recorder*** an appropriate distance from the activity to permit hearing and/or recording of results or observations.
- Use an overhead projector to show step-by-step instructions. Mask all the instructions except the one(s) that you want followed next for students with vision impairments.
- Use ***Descriptive Video*** for videos or laser disks. If descriptive video is not available, use a sighted narrator to describe movies, videos, laser disks, or slides.
- Provide means for the recording of data in an appropriate and familiar mode to the student.
- Tag shapes and relationships (such as distance comparisons) with buttons or other markers on a "layout" board.
- A ***Braille label maker*** will be useful in the laboratory to the vision impaired student who reads Braille.
- Make equipment available that the student can access in interpreting and understanding the results of the laboratory exercises (***audible readout voltmeters, calculators with Braille printouts, talking thermometers and calculators, magnifiers, X/Y Braille plotters.***
- Use a hot plate for heating instead of flames.

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- Use tactile (braille, other) labeling on all containers in the laboratory.
- Label material, supplies, and equipment with regular print, large print, and Braille, as appropriate.
- Pair the vision impaired student with a sighted student. Then have the non-impaired student describe outcomes as they are observed.
- For low vision students using computers use ***MAGic*** for on screen magnification.

Reading

- Paid or volunteer readers or writers can assist a visually impaired student with texts, materials, and library readings .
- Offer to read written information for a person with a visual impairment, when appropriate.
- Arrange ahead of time for audio book acquisition of the text and other reading materials through the ***Talking Book Service***, ***Recordings for the Blind***, ***text reading systems***, or ***computer reader/synthesizers.***

Field Experiences (active and passive)

- Make all handouts and assignments available in an appropriate form(e.g., regular print, large print, Braille, or cassette).
- Use a sighted guide.
- Do detailed narration of objects seen in science centers and/or field excursions.
- The use of a ***laser cane*** or ***mowat sensor*** will be useful in helping the student in unfamiliar surroundings.
- Use an enlarged activity script or tape to go along with tactile models.

Research

- Use appropriate lab and field strategies.

Testing

- Make arrangements for tactile examinations if touch is not normally permitted (e.g., with a museum curator or a plant/animal species collection).
- Place the student being tested closer to the activity for tactile examination.
- Present examinations in a form that will be unbiased to visually impaired students. Ask the student for the approach he/she finds most accessible.
- Record test questions on tape and have the students record their answers on tape.
- Use an activity script or tape to go along with tactile models and/or examinations.
- Allow more time.

Assistive Devices, Services, and Materials

- ***Light probe*** -used as part of readout devices which emits a tone which increases in pitch proportionally to changes in light intensity.
- ***Microprojector*** -a microscope that produces an image for projection on a screen.
- ***Opaque projector***-use for enlargement (which can also be used with a Polaroid snapshot, or other visual presentations).
- ***Descriptive video(DVS)***-a narration of the non-verbal sections of a video or laser disk.
- ***Voice output "talking" equipment*** -equipment which outputs information in an auditory mode.
- ***Raised line drawings***-indented traces which are raised and done on transparencies (a ball point pen and blank overheads will do).
- ***Talking Book Service***-provides voice recordings of printed materials. Available through most public libraries and the Library of Congress.
- ***Recordings for the Blind***-records specific materials for distribution especially textbooks, there is no charge.
- ***Braille Label Maker***-a portable device used to make plastic Braille labels.
- ***Text Reading Systems***-a system that scans printed text, translates it into computer files which can be converted to Braille, or can output to a voice synthesizer.
- ***Laser Cane***-emits beams of invisible light which results in sounds or vibrations when the beam encounters an object, so as to alert the user to an obstruction ahead.
- ***Mowat Sensor***-a hand held unit that warns the user of an obstacle through vibration.
- ***Audible readout Voltmeters***-converts voltage readouts from equipment to audio.
- ***Electronic calculator***-which outputs to audio or Braille printout.
- ***X/Y plotters*** that produce braille output.
- ***"Talking "thermometers and "talking " calculators***-audio outputs as above.
- ***Tape recorder***-two types are normally used: standard or four track variable speed
- ***Overhead projector***-standard.
- ***Magnifiers***-(student should choose type)
- ***Computer synthesizers***-various voice output devices, same applications above (e.g. sound blaster).
- ***MAGic***-a software system for magnification of on- screen information.
- ***3-D Models***-three dimensional models of objects used in teaching activities.

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